Finding the NEXT thermal

Finding the first thermal of the flight is easy: you simply let the towpilot take you to it, and you release once you're there. As soon as you do release, however, you should be thinking about where to find the next thermal because you won't know how long that first thermal will last. Early in the day, when we're all just starting out, thermal tops are likely to be rather low—and in any event you might have released near the very bottom of the thermal you've just found. You simply have no way of knowing.

Many beginning soaring pilots feel anxious about their ability to find "the next thermal," and what follows are suggestions that will make this task much easier.

Looking for the next thermal: When circling in a thermal, you get to see in every direction. As a matter of fact, you see the world in a sort of time-lapse manner, since each circle takes around twenty seconds to complete. Use this effect to aid your search for your next thermal. (Later in the day, when cumulus clouds are more likely present, in a similar manner you can spot active, growing clouds by comparing their appearance from one circle to the next.)

Since we can't see thermals themselves, what should you look for?

Birds circling at about your altitude
Sailplanes circling at any altitude—especially those below you
Dust devils—especially new ones just forming at the surface

Tip Don't forget to allow sufficient time for the top of the dust devil's thermal to reach your altitude. A reasonable assumption is that the core air in a Great Basin dust devil is rising at about 10 kt (1000 ft/min), so plan on arriving overhead no earlier than the time the top of the thermal would reach your altitude. It would be inefficient and risky to arrive before the thermal has reached your altitude, but it is a very common error.

There are other visual clues that you may use, but these are generally only available much later in the day. For example, in the Great Basin it is common to see blowing dust on dry lake beds. If you see two streams of dust converging (angling toward each other) it is almost certain there will be a surface thermal at the point where the two dust streams would intersect. However, early in the day, when finding the second thermal of the flight is the problem, there will probably not be enough surface wind to make this method useful. Remember this trick for later on. Of course, if cumulus are present, pay attention to them!

What else should you look for? When searching for the next thermal, pay attention to every available clue to surface wind direction. Ponds and reservoirs will often show ripples on the surface, and the upwind edges, where the water surface is partially shielded by the bank, are usually free of ripples. You should also make a real effort to pay attention to your sailplane's drift, both its direction and speed. A classic mistake early in the day at Air Sailing is to release and work the first thermal along the Dogskin Mountains until it peters out, then to return to the same ridge to look for the next thermal—never realizing that the wind direction has reversed and that the east slopes of the Dogskins are now sheathed in descending air. Don't do this!

Surprisingly small surface discontinuities are often enough to "trigger" a thermal: individual buildings, tree lines, the edge of a cumulus cloud shadow, the boundary between dry and irrigated fields, small rises—particularly if they have abrupt or sharp edges. Those microwave or cell phone towers that have become increasingly common on ridgetops are often very good thermal triggers. Plan your search to efficiently cross as many of these types of objects as possible.

Anything else? There's ALWAYS "something else." That's what makes this game so much fun! While cumulus clouds probably won't figure in finding your second thermal—because the day is still too young—shadows of cirrus clouds are very effective in inhibiting thermals wherever they fall. (Why is this? Because thermal formation is not just a matter of heating, but of relative heating. The shadowed areas receive less solar heating than the areas basking in bright sunlight.) Pay close attention to cirrus shadows, and try to arrange your search so as to minimize time spent over areas that are currently—or have recently been—in shadow. (Here "recently" means "within the last 3-4 minutes.")

> **Tip** Fly a good heading while searching for the next thermal, but hold the stick only lightly, almost gently. Listen to what the sailplane and the air are trying to tell you. A gentle touch on the controls will help you detect those soft-edged early thermals, and holding an accurate heading will prevent the glider from wandering away from thermal cores.

Plan your search path to avoid passing through the same points twice. This usually means striving to explore areas as far out from the airport as possible, gradually working in closer and closer to the airfield as altitude is lost. Remember, once you get low, you will have lost the ability to search for lift—or to make use of lift other pilots might be finding—unless you can find another thermal close enough to the airfield to be safe. Airports are generally located in the valley floor, which are usually not the most productive thermal search areas.

Tip Resist the temptation to husband your altitude, even when low. **Normal speed-to-fly rules apply** here, so do speed up appropriately when traversing an area of sink. Yes, you're trying to delay the inevitable landing, but efficient flying—including using the correct airspeeds—will substantially increase your search radius and improve your odds of finding lift. By the same token, pay attention to reduced sink rates, and slow down appropriately when they occur. The typical sailplane, flown at minimum sink speed, descends at 1.0-1.2 kt, so air rising at even 50-60 ft/min (slower than your hand moves when you reach out to shake hands) will virtually double your search radius—but only if you slow down.

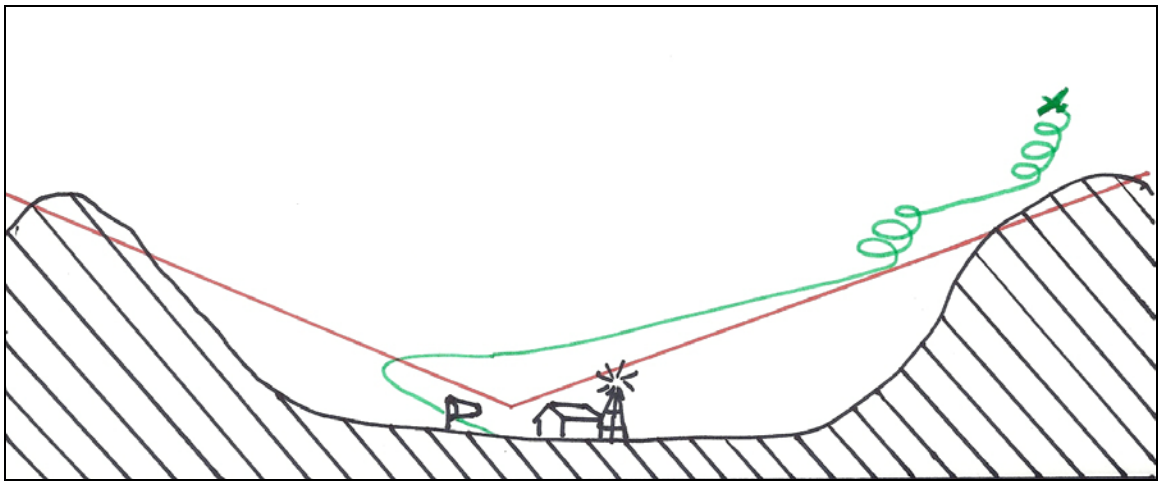
Using local knowledge: If you've been paying attention to the light surface winds that usually occur early in the day on those days that will provide good thermal soaring, you'll have released near the Red Rocks if the winds are from the west or southwest, and near the Dogskins if the winds are from the east or southeast. Suppose today you released in lift on the Dogskins…then the lift petered out. You naturally flew south along the Dogskins, following the contours as best you could, without finding lift, then visited the Moonrocks. No dice. No problem! If you've paid attention to flights under similar conditions, you'll remember that there is often lift over the spot where Air Sailing's emergency runway approaches Winnemucca Ranch Road, and also over the little hill we call The Knoll. In a similar way, on southwest wind days there is often lift near the flat-topped hill off the end of Runway 35…and while we're at it, this is a common place to find wave lift, too. Local knowledge is good—but it's not essential; there are many cases of visiting pilots winning contests while flying against the locals.

Tip Don't just wander around, looking for lift: actively plan your search, then carry it out. Be decisive! Remember that just because flight on a given heading hasn't yet found you a thermal, this doesn't mean that there isn't a thermal ahead or that any other heading would be an improvement. Drastic turns in sink are almost always counterproductive—and flying straight lines allows you to explore a larger area.

Using the terrain: Sunlight travels through the air without appreciably warming it; the solar energy strikes the ground and warms it, and the air adjacent to the surface is heated by conduction. Convection—thermals—is nature's way of distributing this heat through the troposphere. As the air rises, of course, it expands and its temperature decreases (at the "dry adiabatic lapse rate" or DALR.) High terrain receives just as much sunlight as lower-lying land, but the surrounding air is cooler than the air at the surface of the valley—so high terrain is a powerful thermal generator. One of the most important ways we find thermals and cover distances in the Great Basin is to gain, and stick to, the high ground whenever possible.

Alas, airports are rarely located on mountaintops, so our problem at the beginning of a flight is to safely extend our reach into the high terrain while also remaining within easy reach of the airport.

Here's a sketch of the situation, and the most productive way to play it:

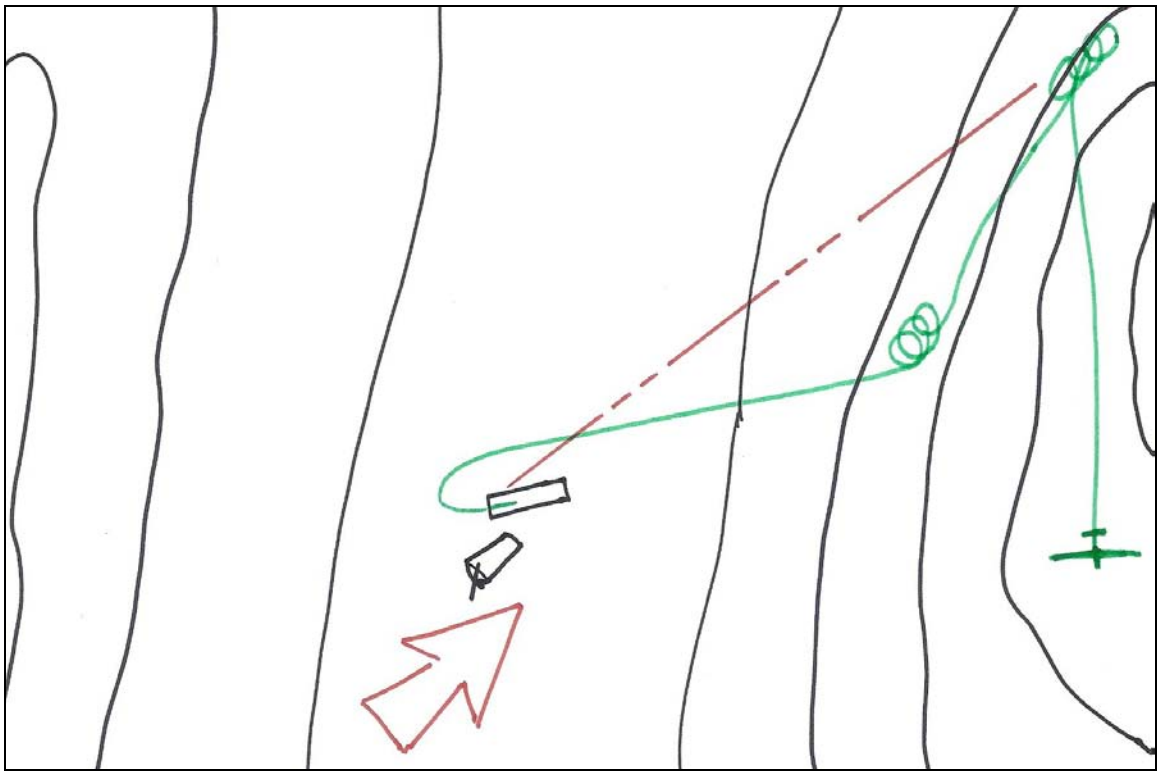


The diagram depicts any one of the hundreds of Great Basin valleys oriented along a north-south axis; you are looking north and the wind is from the west. The takeoff was into a light wind of 5 knots, and the tow pilot turned back toward the airfield as early as was prudent so as to keep the sailplane pilot above her cone of safety (drawn in red.) The tow took the sailplane into the higher terrain downwind of the airport, where the pilot released in lift. Working this thermal took the sailplane well above its cone of safety—which allowed the pilot to fly deeper into the high terrain, where the second thermal was found.

> **Tip** As much as possible, **avoid making turns except when in lift!** Plan your search so that you can depart each thermal headed in the direction you next intend to fly. On a convective day, any air that is not rising is liable to be sinking—and making turns in sink is extremely expensive. Not only are you descending at a fairly high rate, you are not covering any real distance while involved in the turn. Remember:
>
> **While turning in sink, your L/D is effectively <u>zero</u>!**

As you may have noticed, the sailplane in the diagram drifted downwind while circling in thermals—just as one would expect. This means that during **each** circle, **before** committing to completing a turn into the terrain, **<u>adequate clearance must be assured</u>**. It is just too easy to get wrapped up in centering the thermal, and neglect this essential precaution! Don't do this, ever.

Now, let's look at the same flight once more—but this time, we'll indulge in a bird's-eye view of things:



As before, this pilot released directly into the first thermal of the flight, which is always good practice. (It's much easier to release into lift than to try to turn back and find the lift after releasing somewhere else.) Upon leaving this thermal, our pilot took up a heading which took the sailplane gradually higher into rising terrain (notice that the flight path crosses a contour line, here depicted in black.) This choice greatly improves the chances of finding an even better next thermal, because thermals that originate over higher terrain generally extend to greater altitudes and offer correspondingly better climb rates, too. In fact, working thermals originating over higher terrain is absolutely the single easiest method of climbing past whatever weak inversions may still persist over the valley floors early in the soaring day.

As emphasized by the broken red line, flying more or less along the face of the ridge downwind of the airfield yields another important benefit: such a course allows a pilot the opportunity to sample significantly more than a mile of ridge terrain for each mile flown away from the airfield. This is an efficient search technique—and one usually overlooked.

After the second thermal was topped, our pilot chose to reverse course to fly southbound along the ridge. Though such a dramatic change in direction might

be unlikely, the diagram was drawn to emphasize the point that it is possible to leave a thermal in any desired direction; there is ordinarily no need to make large heading changes when flying in sinking air. Plan ahead so you won't have to do this!

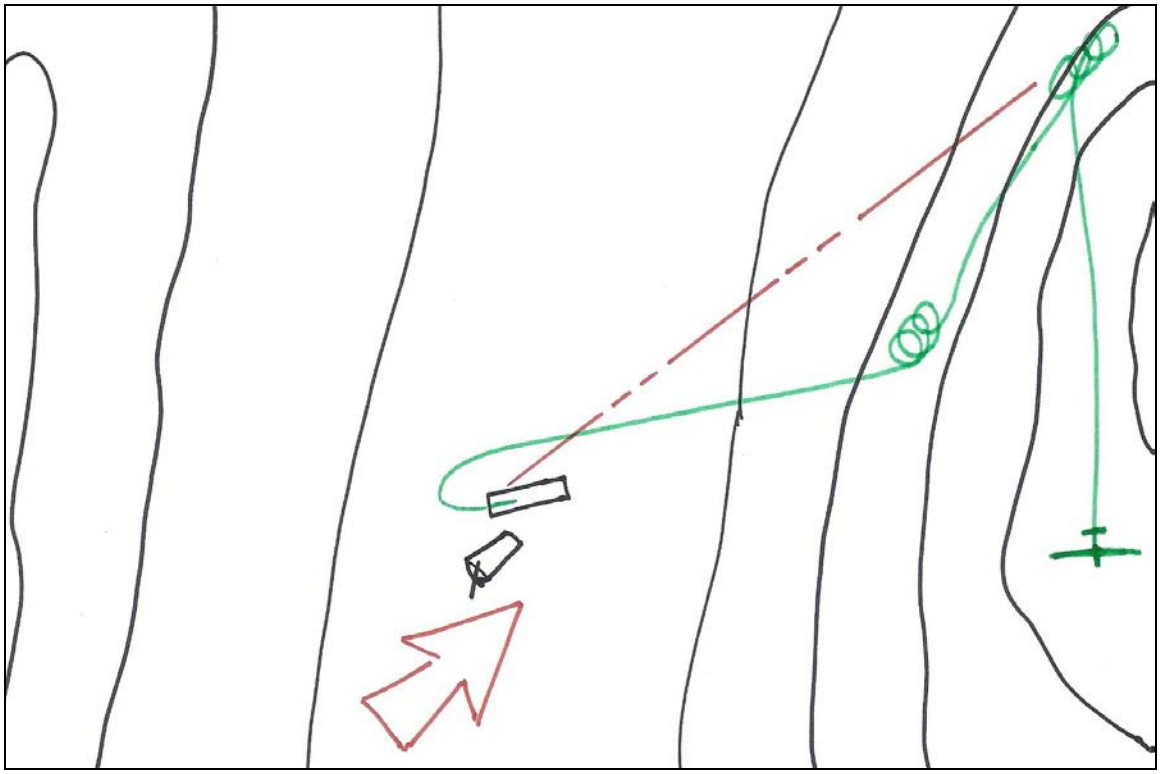
But if for some reason you do need to make a major turn, do so efficiently:

> **Tip** Any turns of more than 60 degrees of heading change while searching for lift should be flown at 45 degrees of bank. Make the turn at normal thermalling airspeed. These choices will minimize altitude lost during the turn. L/D isn't a consideration because a glider making that significant a change of course effectively isn't covering any distance at all.

Keith Lu photo

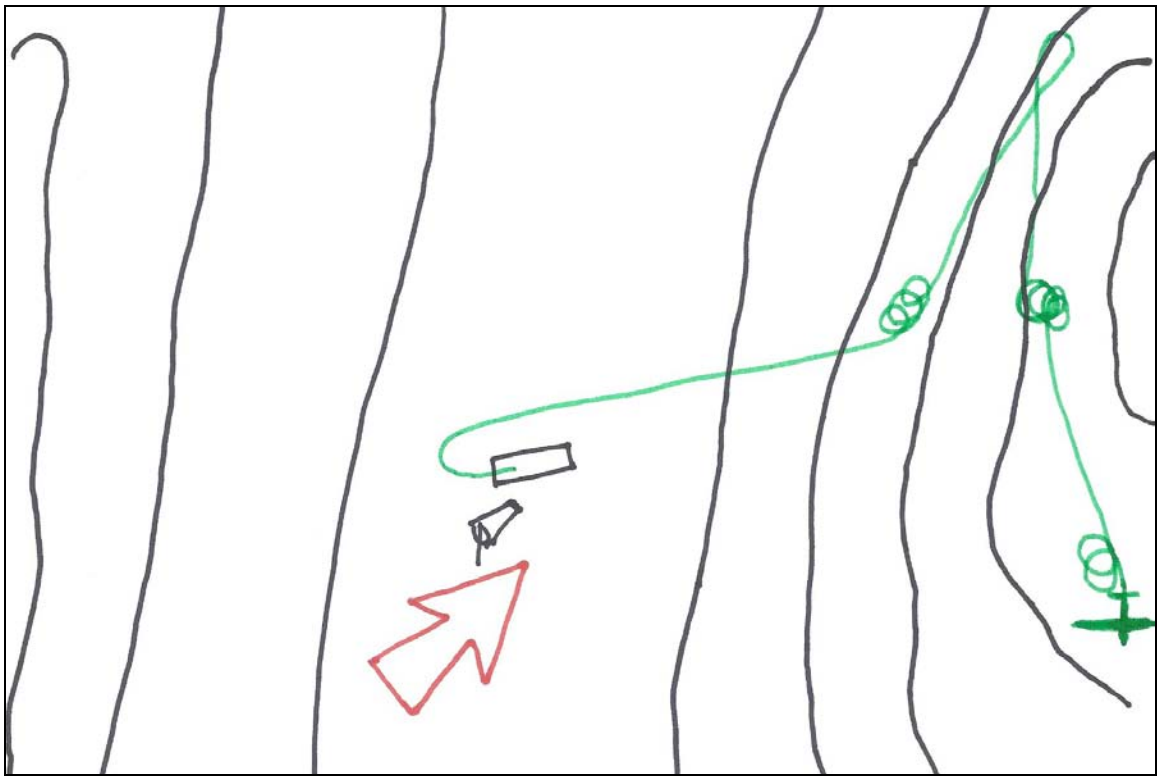
This photo illustrates how a strong thermal can "punch through" an inversion. While this particular thermal is the result of a sugar cane fire on Maui, strong thermals formed over high terrain often behave in the same way when weaker thermals formed over the valley floors are unable to do so.

Let's return to the bird's-eye view of the hypothetical flight and consider a couple of other possibilities. We'll begin by refreshing our memory of the initial example, in which our pilot used two thermals to reach the highest terrain:



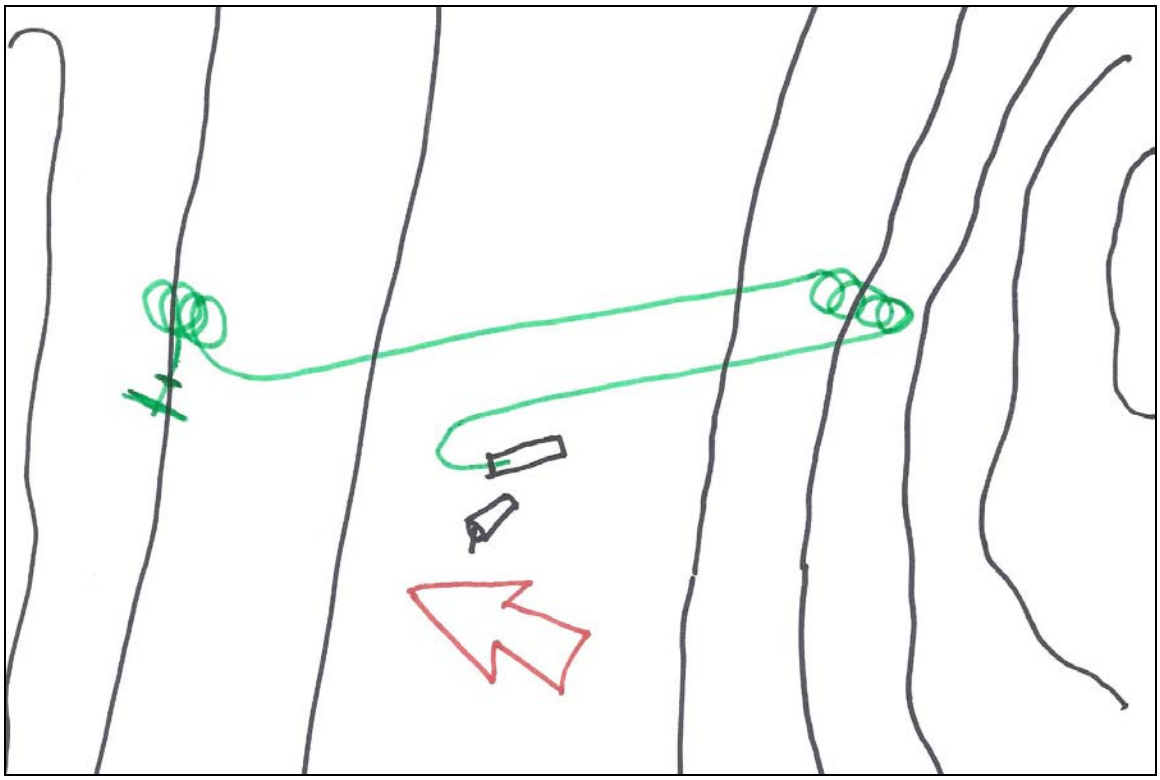
In this example, our pilot found her second thermal when she had just about reached her cone of safety. But what if, instead of a good thermal, this location yielded just half a turn of decent lift, after which the thermal plainly "fell apart"?

What would you do in this stuation?



In this case, our pilot shrewdly used the weak lift location as an efficient place to turn around; having nearly reached the limit of her safe gliding range back to the airport, she would have been obliged to turn back very soon anyway. The modest altitude gain did allow our pilot to continue exploring the high terrain, where another suitable thermal was found. Notice that it was uphill, and downwind, of the thermal found earlier; this is not uncommon. Pay attention to any observable regularities and patterns such as this one…this includes the position of thermals relative to the ridgetops, the manner in which cumulus cloud shadows often line up in rows, the angle at which thermal columns on any given day lean, and so on. The best soaring pilots aren't necessarily those with sophisticated metoerological training, but those who are quick to notice—and to make effective use of—those patterns that other pilots just don't catch.

Here's a good example of the benefit of staying aware of your surroundings:

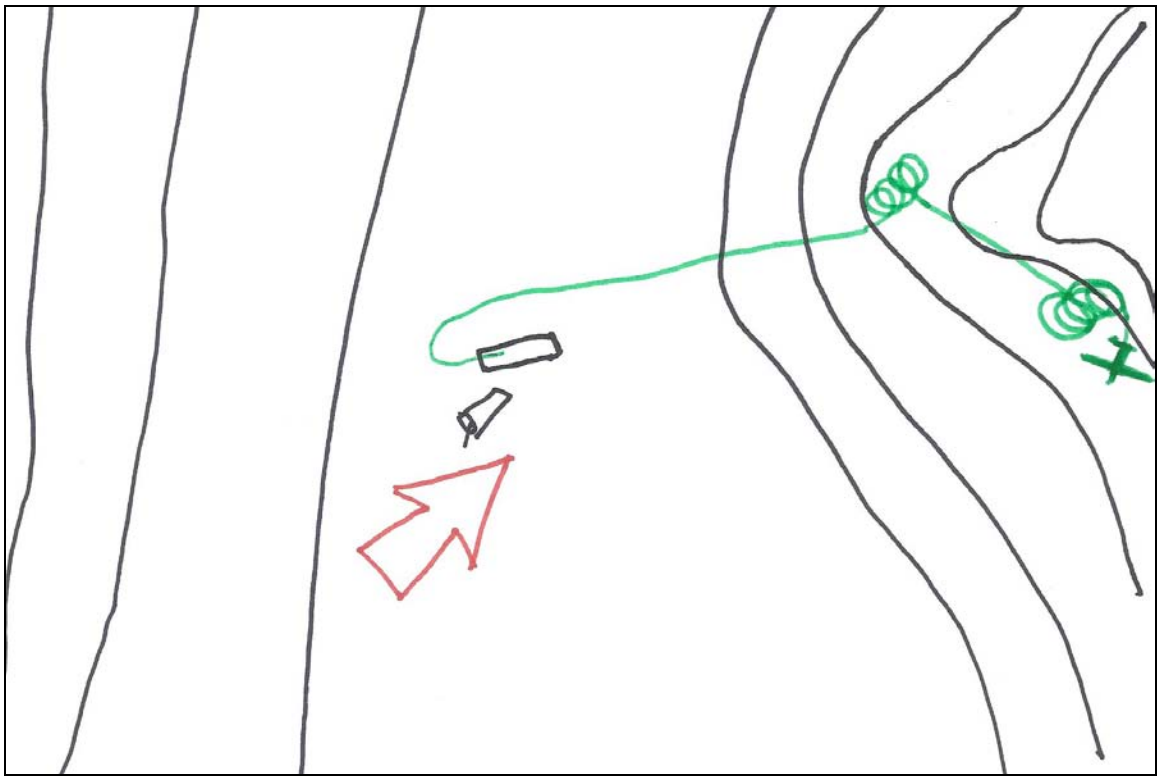


Here our pilot released in rising terrain downwind of the airport, as before—but notice the red wind arrow: it has swung around and no longer matches the wind direction at takeoff (symbolized by the windsock.) Our pilot, paying attention to her drift, realized that the wind had shifted and that further thermal triggering off what is now the lee side of the slope is unlikely. She used the altitude gained in the frst thermal to cross the valley and fly into the high terrain over there, where she found her second thermal.

Under the circumstances, remaining on what is now the downwind side of the valley's eastern ridge would have been a very poor choice; coming up with a new plan—and resolutely carrying it out—resulted in a successful thermal search.

It is worth noting that early in the soaring day, when surface winds are still very light, it is common for the wind direction to radically change several times before the afternoon westerlies finally establish themselves!

In the examples already discussed, there was nothing about the terrain that suggested that any particular point along the ridge would be especially likely to trigger thermals. This is not always the case, and when searching for thermals you should be alert to the thermal-generating aspects of the terrain around you. Here's an example:



In this case, near the top of the ridge there is a “bowl” oriented facing into the local wind; this wind is still just 5 knots or so—not really enough for purely orographic ridge lift but plenty strong enough to help produce usable thermals. Accordingly, after topping the first thermal our pilot headed toward that bowl and was rewarded with a good thermal there.

Summary:

In the Great Basin, the best lift will almost always be found over the high ground. Work your way toward the highest ground within reach.

Pay attention to the surface wind direction and consider how this wind will influence flow over the hills and ridges. Early in the flight, surface winds will be light and will probably change. Watch for this.

Remember the importance of surface discontinuities in triggering thermals. Pay close attention to shadows.

Plan a methodical search, then fly the plan. Don't aimlessly wander.

Fly and hold precise headings, but hold the controls lightly so as to feel what is going on in the air around you.

Avoid making major turns in sink. Such turns are only necessary when reaching the limit of a safe glide back to the airfield or other safe landing area.

Use thermalling speed and 45 degrees of bank for all major turns--in lift or sink.

Fly MacCready speeds unless within "stalling distance" from the surface. Slow down in reduced sink or weak lift so as to extend your search radius.

Plan your exit from each thermal so as to fly directly to where you believe you'll find the next thermal. You'll be surprised at how often you're right!

Conclusion: finding the first thermal of the flight is easy—you let the tow pilot tow you into it. Finding the second thermal of the flight shouldn't be much more difficult than this if you use the tips and tricks discussed here. But what if there just isn't another thermal out there? (This is the most common concern of the beginning soaring pilot.) In that case, after landing, you should seek out and thank your tow pilot: he managed to tow you directly to the only thermal in the entire valley! Talk about finding a needle in a haystack… As you can imagine, this situation is really quite rare.

Good luck, and good hunting!